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Observations on Strabismus

OBSERVATIONS ON STRABISMUS.

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Convergent squint is an exceedingly common deformity, and with the laity and the majority of the profession, it is considered an affection of minor importance, amounting to nothing more than a defect in personal appearance. Unfortunately, this happy conclusion is a false one, for, in most cases, strabismus is indicative of the presence of an optical defect, and is in reality an important diagnostic feature in many cases of cerebro-spinal disease.

Hypermetropia is known to accompany, if not to produce, the majority of cases of convergent squint. Donders estimates that at least 77 per cent. of all the people who are affected with squint, are the subjects of hypermetropia, and Mathener's estimate even exceeds that of Donders' by almost 7 per cent. Hypermetropia is not the result or sequellæ of any pathological change in the globe, but is due to an anatomical defect, in which the antero-posterior diameter of the eye-ball is shortened, in consequence of which the focal distance of the crystalline lens falls behind the retina instead of falling on its surface at the fovea centralis.

It is not always the highest degrees of hypermetropia that are accompanied with convergent squint, for it exists in a high degree, in some instances, where there is no deviation. In young persons it may be latent, and not manifest itself until the accommodation has been paralyzed. In periodical oblique vision, which is the incipiency of permanent strabismus, it can be proven that hypermetropia already exist, hence, it precedes the squint.

Again, when it is understood that the incipient strabismus gives way when the hypermetropia is corrected by a convex glass, we can readily understand how it may produce strabismus. The question now arises, as to how hypermetropia can produce squint; every eye, in its physiological condition, possesses a peculiar power, known as its power of accommodation, or in other words, the power of focusing the organ for different distances, and for objects of different sizes at a given distance. An emmetropic eye, or an eye in which the rays of light are focused upon the layer of rods and cones, enables its possessor to observe objects of a given size under an angle of five minutes at or beyond twenty feet distance without any effort on the part of the accommodative apparatus. This may be demonstrated by paralyzing the accommodation, when the fact will be evinced that the test type No. XX which appeared clear before, may still be read by the unaided eye with as much accuracy as before the paralysis.

The subject of hypermetropia may read the test type No. XX at the required distance with little or no difficulty, before suspending the focusing

power; this, however, is no evidence of the absence of hypermetropia, as it may be latent, and require paralysis of the accommodation to render it manifest. When the accommodative apparatus is rendered inactive by the use of atropia or dubosia, the hypermetrope no longer reads his twenty-twentieths with the unaided eye, but must have the assistance of a convex lens to bring the focal point from behind the retina, and allow it to fall on the surface of the rod and cone layer.

In the hypermetropic eye the angle between the polar axis of the cornea and the visual line is at least two degrees more than that of the emmetropic eye. This angle in the non-squinting hypermetrope, on an average, equals 6.56°, while that of the squinting hypermetrope equals 7.63°, and, according to Donders, that of the emmetrope equals a fraction more than 5°. Now, the great difference between the polar axis of the cornea and the visual line in the hypermetrope renders it difficult for him to fix both eyes upon the same object, and in his effort to accomplish the act of fixation, the accommodative apparatus is put upon an unendurable strain, which induces an abnormal amount of activity in one or both of the internal recti-muscles, and a corresponding amount of exhaustion or lethargy in one or both of the external recti-muscles. This state of things exists to a moderate degree at first, but after a time the constant contraction of the internal recti, and the corresponding relaxation from disuse of the external recti becomes extreme—if I may be allowed the expression—and in consequence of this, the power of the internal recti continuing to predominate, as a natural result, the eyes converge. The deviation may exist in both eyes at the same time, or it may alternate, and be present in first one and then the other. As a rule, the deviation is usually more marked and constant on one side. Hypermetropes, with concomitant convergent squint, rarely, if ever, enjoy perfect binocular vision; the eye apparently least affected is the one used most, and in some cases the only one used. The inactivity of an eye very soon brings about morbid conditions in which the rod and cone layer of the retina participates, rays of light fail to make the proper impression, and imperfect images are formed. If there be no effort made to correct the optical defect, it may be expected in the course of time the eye that is unused will be so amblyopic as to be almost useless.

Treatment.—The correction of squint is by no means an easy task. Indeed, in many instances, it is very difficult. A knowledge of mechanics and optics is essential; in conjunction with these, a certain amount of skill is necessary. Any surgeon may perform tenotomy, but this is a matter of secondary consideration. When to perform tenotomy, and whether it shall be double or single, and the extent of the conjunctival wound, are points to be determined with accuracy. The fact that both eyes deviate does not imply that both must be operated on; nor does mono-lateral strabismus indicate the operation must be confined to one eye. The question whether one or both shall be operated on, nearly always depends upon the amount of deviation.

If the deviation exceeds 3‴ it will be necessary to operate on both eyes; but should it be less than 3‴ the division of the tendon of the internal rectus of the deviating eye, with rather free incision of the conjunctiva, will usually suffice. This rule is particularly applicable to children. The object of operating on both eyes is to preserve, as nearly as possible, the associated movements of the two organs. Dividing the tendon of a rectus muscle for the correction of squint is equivalent to shortening the muscle, in a certain sense of the word, inasmuch as it retracts and becomes attached to the sclerotica some distance behind its former inser-

tion. The same thing would occur if a portion of the muscle were entirely removed. The only difference in results would be, that in the case where a part of the muscle had been removed, there would be a greater amount of deviation, with a corresponding loss of power on the part of the injured muscle, and in the direction of that organ. If a rectus muscle retracts more than three lines, the eye to which it is attached will usually deviate in the opposite direction sufficiently to cause a loss of motility, which will amount to a defect; hence, the necessity of dividing the correction between the two eyes by operating upon both.

The operation of tenotomy should be performed, if possible, without an anæsthetic, because its influence so thoroughly relaxes the muscular system that it is impossible to determine when the operation has been completed. Of course, the anæsthetic is indispensable in young children and nervous women.

As to the particular methods of operating, the writer prefers Von Graefe's, or the sub-conjunctival, with such modifications as individual cases may suggest. The method of Von Graefe consists in seizing the conjunctiva near the edge of the cornea, opposite the end of the tendon, and with a pair of scissors, curved on the flat, make a small opening in the conjunctiva and underlying tissues. When this is done, the points of the scissors should be directed up and down, and the structures dissected, so as to allow the opening to appear funnel-shaped. The strabismus hook should then be introduced in such a manner as to allow it to slip beneath the tendon. When the tendon has been secured, sufficient tension should be made with the hook to hold it firm, without making any effort to draw it out.

If the conjunctiva should be in the way, when the forceps are loosened, it may be pushed back. In dividing the tendon, care should be taken to cut it close to the sclera, *i. e.*, between the hook and the sclera. Every fiber of the tendon should be severed, because if a few fibers are left the result of the operation would certainly be unfavorable. The sub-conjunctival operation is similar to that of Von Graefe. The only material difference between the two methods is, that, in the latter, the opening in the conjunctiva and underlying tissues is much smaller. When the tendons are severed, if the effect is not sufficient, the conjunctival opening may be extended in the vertical meridian by making a small cut above and below. Caution should be used in extending the wound in the conjunctiva, as it is possible that by this procedure the eye may be made to deviate more than is desirable, and the caruncle may also sink if the wound in the conjunctiva is too wide. When the caruncle sinks, the eye-ball apparently protrudes, and produces an ugly deformity. After the tendon has been cut, the eye may deviate more than was anticipated. In such cases, the tendon should be brought forward and secured by sutures at such a point on the globe as to insure the necessary degree of correction. I am aware that this procedure will seem very difficult to an inexperienced operator, but when done with care and prudence, it will be found to be thoroughly practicable, and satisfactory in result. A very slight degree of divergence is rather desirable just after the operation, as it assures us that the object of the operation has been thoroughly accomplished. The slight contraction which always occurs by the attachment of the muscle to the globe will usually correct the apparent excess of divergence, and make the success of the operation perfect. If the patient has been operated upon without an anæsthetic, and the eye should deviate to an extent to make it evident that the tendon should be brought forward and secured to the globe, it should be done at once. On the contrary, if an anæsthetic has been used,

it is, probably, best to wait ten or twelve days, and see just what amount of correction may be demanded; because the influence of an anæsthetic always leaves the muscles in an uncertain state of activity, and what might appear to be a great amount of deviation, while temporarily under the influence of chloroform would all disappear in a few days—hence the importance of waiting in such cases.

The cases capable of being corrected by lenses are those where the deviation is slight in both eyes or where it is only manifest in one eye, and even in some of those cases the lenses fail to accomplish the desired end. In order to determine the glass needed for the correction of any case of strabismus, it is necessary to paralyze the accommodation and ascertain the degree of the error of refraction. When this is done, a prism of sufficient power to correct the deviation should be selected and combined with the lens which corrects the hypermetropia and used as a spectacle glass.

This method is preferable when it can be resorted to, but, unfortunately, the sufferer rarely seeks the advice of the oculist until it is too late to obtain relief from this device.

Prismatic lenses, in such cases, usually produce considerable pain, on account of the unusual strain induced.

Glasses to correct existing hypermetropia are necessary after tenotomy has been performed, because the tenotomy does not correct the hypermetropia, and, in order to prevent a recurrence of the squint, it is necessary to remove the cause, or, more properly speaking, to correct it, which is done by the addition of suitable convex lenses.

In the incipiency of strabismus, when only one eye deviates, and when there is binocular vision, with fusion of the double images by voluntary muscular effort, regular and persistent exercise of the eyes with a prism in front of the deviating one, of sufficient strength to unite the images, is of decided benefit in many cases. This method requires considerable patience both on the part of the surgeon and patient, and requires to be persisted in for a great length of time. In conclusion, it must be borne in mind that it is impossible to determine with exactness, the degree of an error of refraction unless the accommodation of the defective eye is paralyzed at the time the examination is made; and furthermore, it must be added that the attempt to ascertain the degree of an optical defect, by looking into the eye with an ophthalmoscope, such as that which has been devised by Dr. Loring, of New York, is of uncertain value. I do not deny the ability of any ordinary ophthalmoscopist to determine the presence of an optical defect with certainty when it is moderately well marked, but I do know that it is utterly impossible for any one to determine the exact degree of an existing error of refraction by this method. Some very good guessing may be done, but accuracy can not even be approximated, because the observer has no more knowledge of just how much he can relax his accommodative power at each observation, than he has of just how many pounds he can lift on a certain day, or just how many miles he can walk in a given time. Either may be roughly approximated, but nothing aside from the absolute test will determine any of man's powers, and as the method under consideration can be approximative only, it is, of course, unreliable, and, therefore, useless.